DOCUMENT RESUME

ED 075 336 SO 005 895

AUTHOR	Thayer, Lee; And Others
TITLE	Toward a Reconceptualization of Knowledge Utilization in Education. Volume 7. Research Memoranda. Final Report.
INSTITUTION	Iowa Univ., Iowa City. Center for the Advanced Study of Communication.
SPONS AGENCY	National Center for Educational Communication (DHEW/OE), Washington, D.C. Div. of Practice Improvement.
PUB DATE	Jan 73
CONTRACT	OEC-0-72-0243(519)
NOTE	106p.
EDRS PRICE	MF-$0.65 HC-$6.58
DESCRIPTORS	Adoption (Ideas); *Communication Problems; *Communications; *Educational Innovation; Information Dissemination; *Information Utilization; Problem Solving; Research Utilization; *Use Studies

ABSTRACT

Two Research Memoranda, numbers 15 and 16, are contained in this volume. (The general nature of the memoranda are described and related documents listed in SO 005 892). The first essay by Daniel E. Costello, entitled "Communication, Knowledge and the Educator as a Problem-Namer", views the problem of knowledge formation and utilization within education systems as resting on problem-naming and problem solving capabilities of individuals within the system. How these capabilities are developed in and through communication is explored. In the second report, Robert B. Miller discusses "The Gulf Between Research and Practice in Education", examining conservatism and public attitudes toward innovation and the adoption of ideas, problems in research content and communication, the process of research and development, and identifying various components to help bridge the gap between research and practice in education. (Author/SJM)

ED 075336

Final Report

Contract No. OEC-0-72-0243 (519)

Lee Thayer
Center for the Advanced Study of Communication
300 Communication Center
The University of Iowa
Iowa City, Iowa 52240

Toward a Reconceptualization of Knowledge Utilization in Education

Volume 7 of 8 Volumes

January, 1973

SP005 895

U.S. DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE

Office of Education

National Center for Educational Communication
(Division of Practice Improvement)

FILMED FROM BEST AVAILABLE COPY

THE UNIVERSITY OF IOWA

IOWA CITY, IOWA 52240

Center for the Advanced Study of Communication
Area 319: 353-3259

U.S. DEPARTMENT OF HEALTH, EDUCATION & WELFARE
OFFICE OF EDUCATION
THIS DOCUMENT HAS BEEN REPRODUCED EXACTLY AS RECEIVED FROM THE PERSON OR ORGANIZATION ORIGINATING IT. POINTS OF VIEW OR OPINIONS STATED DO NOT NECESSARILY REPRESENT OFFICIAL OFFICE OF EDUCATION POSITION OR POLICY

Project: NCEC Knowledge Utilization Study

Research Memorandum #15:

"Communication, Knowledge and the Educator as a Problem-Namer"

Originator: Daniel E. Costello

Date: September, 1972

Distribution: Project Associates*

Research Assistants

NCEC Officials

Practicum Participants

Consultants

Contributors

Public Inquiries

Communication, Knowledge and
The Educator as a Problem-Namer

by

Daniel E. Costello

The Office of Education has made available to educators a great deal of research knowledge. A primary assumption seems to be that if an educator utilized this knowledge he would be able to cope better with his everyday problems within the educational system. As I suggested in the initial proposal (p. 6, part d), knowledge utilization can be looked on as a process of socialization or as a process of therapeutic change (5). The locus of change, however, is the key issue. For example, it could be argued that there would be no need to establish separate systems for producing and disseminating educational research if the educational systems involved were functioning optimally.

I began with a thorough review and assessment of the key literature in psychotherapy (see Addendum to this report). Initially, my purpose was to establish a taxonomy for assessing system "pathologies." It became apparent, however, that the problem of knowledge formation and utilization within educational systems rests on problem-naming and problem-solving capabilities of individuals within the systems.

How these capabilities are developed in and through communication is explored in this report. One of the major problems is to help educators understand the stresses of their educational environment and, if need be, to find ways of changing not only themselves but perhaps also their environments. It is essential for an educator to develop understanding of relationships between himself and his environment and how these relationships are formed, maintained, and changed in and through communication.

The long-range policy recommendation of this report suggests that NCEC develop a closer correspondence between its "knowledge" systems and the communication systems of its potential users. The shorter-range recommendations will be outlined at the end. All recommendations, may, involve major changes in how readers of this report view functions of communication and knowledge in educators' problem-naming and problem-solving experiences.

A problem in dealing with contrived knowledge systems is in how we conceive of communication. We all know that we communicate and through our many years of experience we have accumulated much evidence and verification of how the process works for us. When we communicate about communication, however, we don't usually assume that our preconceptions might be at odds with those of others.

Three levels of inquiry may help to explain the actions of people participating in communication (14).

The first level defines communication in terms of subjective experiences of a person. On this "self-actional" level, a person is viewed as acting solely under his own power with emphasis placed on his thoughts and feelings in an experience. The second, or "inter-actional" level, looks at a person balanced against other people in causal interconnection. This approach has lead to the study of communication in terms of observable characteristics of knowledge and the responses people make to it. Kelley remarks, "For a long time, it had been assumed that the organism which received the stimuli was only a receiver, that the object from which the stimulus originated was all-important, and that the viewer had no choice but to see it exactly as it was. If he did not see it as it was, then he was blamed, condemned as stupid, and efforts were made to correct him. This assumption placed the learner in a position of unimportance and insignificance" (10:252).

The third and most heuristic level attempts to bridge the gap between the two proceeding levels. This level of inquiry analyzes communication processes as they function within the total life experiences of a person. As a functional approach, it does not place major emphasis either on a person or on those things external to him, but on the relationship of a person to his environment. Unlike the interactional approach, the "transactional" starts with a person and works toward knowledge. When we participate in communication, there is never a single message, but a multiplicity of possible interpretations or messages. Verbal messages, facial expressions, bodily gestures, and context all become part of the analysis of communication, since they are crucial in trying to

determine what is worth knowing for coping with our problems. This view considers communication as a process actively engaged in by a person as he moves through real-life situations.

The shift in communication studies is away from self-actual and interactional orientations and toward the acceptance of communication as an essentially creative process engaged in by man. Most past studies have looked upon the relationship between communication and knowledge from the framework of the first two levels mentioned. The knower-known relationship was not seen as crucial in analyzing a person's actions in a situation. Messages or knowledge were thought of as existing in their own right, and differences in persons' responses were treated as differences in subjective responses to the same knowledge. Hastorf and Cantril comment: "It is inaccurate and misleading to say that different people have different 'attitudes' concerning the same 'thing.' For the 'thing' simply is not the same for different people whether the 'thing' is a football game, a presidential candidate, Communism, or spinach. We do not simply 'react to' a happening or to some impingement from the environment in a determined way (except in behavior that has become reflexive or habitual). We behave according to what we bring to the occasion, and what each of us brings to the occasion is more or less unique" (7:133).

A transactional framework has been a most functional approach in psychotherapy. Psychoanalytic theory has assumed that an individual structures his world through his communication experiences. Most contemporary psychoanalytic writers stress the

importance of the communication process in shaping the content of an individual's experiences (13,17). Knowledge, then, represents the significant experiences that an individual has found useful in his life situation. According to Kelley, "Knowledge is what we know after we have learned . . . we are wont to think of knowledge as lying "outside the learner, to be acquired by him in much the same manner as he might pick up any object with his hands. The difference is that when one picks up an object with his hands, it never becomes a part of him, whereas when he learns, something new is built into the learner in the only way that it can be truly incorporated, that is, through his unique perception process" (10:254). It is through communication that each one of us becomes aware of the world outside of himself and ultimately of himself as a human being.

Let us keep in mind that the relationship between a person and his environment is not a one-way street since the boundary of a person is also a boundary of his environment. In dealing with his environment, each person acts in terms of the world as he takes it into account. He can do no more. For his world of experiences is the only world in which he will ever live. So from a communication point of view, the way he experiences the consequences of his own actions determines the effect of his activity on his coping behavior. Communication, then, provides both the framework on which action is based and the channel through which the consequences of action are experienced.

If we reflect on our own experiences, we find it is virtually impossible to think of anything we do which is not interwoven with communication. Since communication cannot be isolated, it can only be studied as part of a situation in which it operates. Neither communication nor knowledge exist independently of the total life situation of which both communication and knowledge are a part. If we try to remove them from the situations in which they are encountered they become meaningless. As Birdwhistell says, "An individual does not communicate; he engages in or becomes part of communication. He may move, or make noises . . . but he does not communicate. In a parallel fashion, he may see, he may hear, smell, taste, or feel--but he does not originate communication; he participates in it. Communication as a system, then, is not to be understood on a simple model of action and reaction, however completely stated. As a system it is to be comprehended on the transactional level" (2:104).

The term "transaction" has been given some unusual implications: first, that all things in a situation--people, objects, etc., enter a situation as active participants; second, that people and objects owe their very existence in a situation to their active participation, and do not appear as already existing entities that merely interact with each other without affecting their own identity (11,4,9). "Transaction" was first used by Dewey and Bentley in Knowing and the Known. They suggest, "Observation of this general (transactional) type sees man-in-action not as something radically set over against an environing world nor yet

as merely action 'in' a world but is action of and by the world in which the man belongs as an integral constituent." It follows, then, that all of man's behavior "including his most advanced knowings" are treated as "activities not of himself alone nor even as primarily his but as processes of the full situation of organism-environment. "From birth to death every human being is a party so that neither he nor anything suffered can possibly be understood when it is separated from the fact of participation in an extensive body of transactions--to which a given human being may contribute and which he modifies but only in virtue of being a partaker in them" (6:271).

To further elaborate, Bentley states: "We do not, however, take the organism and environment as if we could know about them separately in advance of our special inquiry but we take their interaction itself as subject matter of study. We name this transaction to differentiate it from interaction. We inspect the thing-seen not as the operation of an organism upon an environment nor of the environment on an organism but as itself an event" (1:285). This statement, for most of us, goes against all we know to be true. For the most part, we treat people and objects as existing in their own right having traits, attributes, characteristics quite independent of our transactions with them. We shall see, however, that this common sense point of view is not useful in formulating an adequate theory of communication.

Each event a person takes into account is not independent of his past transactions and his future expectancies. An

event represents an arbitrary point along a continum of life's experiences. For the purpose of being able to reflect on them, the experiences are pulled out of the process and given a beginning and an end. Each represents a unique reflection.

As Whitehead states, "An event has contemporaries . . . . This means that an event mirrors within itself the modes of its contemporaries as a display of immediate achievement. An event has a past. This means that an event mirrors within itself the modes of its predecessors as memories which are fused into its own content. An event has a future. This means that an event mirrors within itself such aspects as the future throws back on to the present; or, in other words, as the present has determined concerning the future . . . . These conclusions are essential for any form of realism for there is in the world for our cognizance memory of the past, immedicacy of realization and indication of things to come" (18:166).

Several implications are involved in the suggestion that an event does not have its own existence and can only be observed through someone's active participation in it. If this is the case, then each person must enter into the transaction from a slightly different perspective since each person is an unique configuration of experiences, assumptions and purposes. A person, then, observes and acts from his own unique point of view. Participation in communication is always an activity by a unique participant from his unique position providing him with his unique world of experiences.

One aspect of a person's world of experiences, however, is how he experiences his own participation in a transaction. He has the ability to communicate with himself or, in other words, he reflects on his purposes, assumptions, and actions, and the consequences of his actions. In addition, his ability to abstract certain aspects of his experiences gives him the opportunity to provide inputs into experiences of other people. This ability allows man to participate in communication with others, yet the transaction is not limited by either space or time. However, Whitehead has characterized one major difficulty with our ability to deal with abstractions which he has called the "fallacy of misplaced concreteness" (12:576). That is, the aspects of our experience which are abstracted tend to be thought of as more "real" than the aspects of our experience which are not symbolized. For many people, then, the process of communication is limited to only those aspects of experience which are verbalized and/or written down.

Abstractions lead people to assume a communality of experience rather than assuming that each person's experience is unique to him. Yet, we know that no two people have exactly the same point of view because of the simple fact that they cannot occupy the same place at the same time.

Since perfect correspondence is impossible, we are left with the notion that one of the most basic processes in our life operates on a whole set of very complex assumptions about ourselves, others, and the world in which we live. We must assume

that people's purposes, assumptions, and orientation in time and space vary in a transaction vary in their correspondence, producing some degree of communality of experiences. Communication, then, is that aspect of the total life process by which each one of us creates a unique world of experiences and through which each of us strives to attain our purposes.

One of the more fundamental assumptions a person makes is that what he takes into account exists outside of himself and has characteristics beyond those he gives them. One essential aspect of communication, then, is the assumed externality for certain aspects of experience. To assume that parts of a person's experiences get attributed to events external to himself adds a new dimension to his experience. Part of the reconceptualizing, then, is that the world as one experiences it is both the product of communication and the cause of it.

Knowledge represents those aspects of a person's experiences that have been externalized formally. The question arises, however, as to what aspects of experiences can usefully be externalized. One of the major problems in therapy sessions is for the patient to learn which aspects of his experiences he has been externalizing and which aspects he has been repressing. It is usually crucial that a patient recognize as his own certain aspects of his experience which he formerly attributed to external events. This is why the study of communication takes the transaction as its point of departure.

Educator as Problem-Namer

The fact of externalization presents quite a problem to the educator's understanding of the process of knowledge formation and utilization. He tends to believe that knowledge exists "out there" apart from himself and independent of his experience of taking it into account. In one sense, then, the answers to his problems are provided in advance of his problem-naming. It is easy to see why so much time and energy go into finding solutions rather than into naming the problem. Most information retrieval systems are based on the notion that objects or people exist in their own right as one takes them into account and all one has to do is fit their problems to the already existing knowledge. Whitehead addressed himself to this assumption when he said. "We must not slip into the fallacy of assuming that we are comparing a given world with given perceptions of it. The physical world is in some general sense of the term a deduced concept. Our problem is, in fact, to fit the world to our perceptions and not our perceptions to the world" (12:89). This statement implies that the solutions the educator creates cannot be understood apart from the way he has named the problem and should not be externalized as independent of this problem-namer. Thayer states, "What is unavoidable, if we are to take what we know about communication seriously, is that a) Problems exist only in people; b) Problems exist only in the form they are conceived of; c) The problem dealt with is the one named or identified (not the "objective" conditions of concern); and d) Given that one can 'get into contact' with his

environment only via his own take-into-account-abilities, the solutions (or potential solutions) one has for problems generally determine the problems he 'sees' or identifies" (15:18).

The point is that problem-naming is a personal experience and can be accounted for adequately only from each educator's unique point of view. Even the educational researcher, in his attempt to "communicate" his thinking and observation on some phenomenon to other researchers, must make statements about what the other researchers will experience if they follow certain procedures. This is so because what a researcher experiences are the variables of his own creation and do not exist independently of how he has named the problem under investigation. So for other researchers to understand his work he must communicate the procedures used, and only in this way can he convey the constructs of his work.

The findings and potential knowledge produced by the educational researcher are meaningful only if the educator has available to him both the conceptual and operational thinking employed by the researcher and only if the knowledge fits his purposes. When the researcher makes operational statements he is abstracting from his own experience certain aspects which he believes are or can be shared with another person. In this process, however, he must recognize the impact of his own values in his problem-naming. As Bridgman put it, "The observer must somehow be included in the system. The point of view of classical physics, and I believe also of all orthodox human thinking up to the present,

was that the observer is a passive spectator, expressed sometimes by saying that what he observes would be the same whether he were watching or not. Quantum theory points out that this is only an approximation valid in the realm of large objects. The very act of observing a small object involves a reaction between the object and the observer, a reaction that must be allowed for in reconstructing the system from observation. To which we now add the insight that the relationship between the observed and the observer is a much more intimate relationship than these quantum considerations would suggest, and that it is in fact meaningless to try to separate observer and observed, or to speak of an object independent of an observer, or, for that matter, of an observer in the absence of objects of observation" (3:37).

No matter what one's professional position in life, the process of communication provides each person with the only world he knows. His predictions of what will probably happen if he acts in a particular way transpire in and through communication. His actions will be effective only insofar as the predictions derived from his past correspond to what he actually experiences when he acts. The central problem of communication is understanding the degree of correspondence between the significant aspects of past experiences which one externalizes in one's problem-naming and those significant aspects which one externalizes in one's present encounters.

The way the educator poses his problem determines what answers he will seek; determines what aspects of the present state

of knowledge will have a bearing on the problem; determines which procedures he will follow or try to devise. Without some indication of the educator's purposes, one cannot evaluate the correspondence between his actions and his problem-naming capabilities. For the significances he encounters in the course of acting can be evaluated only in terms of what he intended to do. It should be clear by now why we have great difficulty in predicting the other's behavior or what they need to know. For educators, like educational researchers, have purposes and it is no easy task to acquire a correspondence between the purposes educators may actually be pursuing and the purposes educational researchers attribute to them.

What does the educator experience? For purposes of discussion, four significant aspects of the educator's experience will be presented (8). One must remember, however, that these aspects do not exist independently of each other; nor, for that matter, do they exist independently of the educator taking them into account.

As we have stated before, the educator tends to experience certain things as entities having their own characteristics and spacial-temporal locations. For the educator this includes books, classrooms, buildings, students, teachers, administrators, parents, educational researchers, to name but a few. If you think about it there are a great many "things" in our environment which have varying degrees of significance for us. "Thing" significances will vary for the educator depending upon his more immediate purposes.

We usually observe objects or people as if they were static things within our environment. However, things seem to be moving in a never-ending series of sequences which constantly occur around us. As with "things" there seem to be an endless number of "sequences" going on around us. Out of all the potential sequences the educator takes into account relatively few, namely those which are relevant to his purposes have some degree of repeatability. Again, for the educator this includes grade levels, modular scheduling, home-room period, school calendar, and anything else that is patterned. We create many devices to ensure that certain sequential events will follow each other in predictable directions.

Most sequential events which the educator deems relevant to his purposes take on added significance for him when he finds himself an active participant rather than a passive observer. It is only through participation that he gets some indication of the adequacy of his point of view in accomplishing some desired result. The significant actions for the educator are those aspects of his experience which revolve around the role that he plays within the educational system. The complexity of the educational system, however, varies for each educator, for his transactions determine the scope of his educational situation.

The educator as an active participant in the educational system is faced with alternative courses of action. Each course of action is evaluated on its probability of leading to the "desired" consequences. (This of course assumes that the educator's behavior is purposive and that he has the capability of sorting out various ways of achieving his purposes.)

One such evaluation involves selection among alternative goals in life. The alternative to be the educator can be weighed against other professions in supplying him with the satisfactions he seeks out of life. This is not a simple process since the choice is contingent upon other goal selections. The point is that the choice is a choice of alternative goals to pursue, and will greatly affect how he participates in communication with others.

A second and more frequent type of evaluation enters more explicitly into the communication process. Once the immediate goal has been decided upon, the educator selects among the alternative means of action. All of these evaluative significances from the lowliest "thing" to the highest "value" are completely and simultaneously involved in any experience.

As we have already suggested, it may or it may not be a simple matter for the educator to decide which aspects of his experience to externalize. To put his experiences "out there," and to have attributed to them an existence independent of the fact of his experiencing them, can become problematic. This type of abstraction is necessary, however, if the educator is to reduce the number of things and sequences he has to deal with. It is impossible for him to deal simultaneously with all the sequences constantly occurring in his ongoing experience.

From a communication point of view, the educator's experience comprises a total complex of significances. In both past and present situations, certain significances have been found by the

educator as having a high probability of satisfying his purposes. Other aspects of his experience have proven not to work, leading to the frustration of his purposes. This evaluating is accomplished through a largely unconscious process and results in a set of assumptions which are brought to the present situation and play a principal role in determining how the situation is experienced. These assumptions constitute the only world he knows and determine his experience, that is, provide him with predictions of probable significances. That is why, in order for the educator to be effective, his assumptions must have some degree of constancy and verifiability.

We know, however, that the constancy of his assumptions vary from transaction to transaction and that his assumptions are hardly ever in complete harmony with each other. Those assumptions from his past experience that have worked for him probably become key guidelines for his thinking and behavior in present situations. There will also be assumptions which are tied very closely with particular experiences, especially those experiences which have had great significance for him. Thus, an assumption enters into the process with a weight determined on a probability basis adjusted in terms of its previous importance to the educator and its relationship to his immediate transaction. The relevancy of an assumption in any situation is always gauged in light of one's particular purposes.

How does the educator change then in order to cope with his problematic situation? One choice for him would be to change

the weighting assigned to his assumptions without changing the assumptions themselves. For instance, the educator after naming a curriculum matter as a problem may lessen his emphasis on lecture presentations and plan more small group discussions for his students.

A second choice for the educator is to adopt totally new assumptions relevant to his purposes. This would be a more fundamental change since it affects not only his assumptions but also his purposes. Needless to say, if both choices were to occur in the same situation, the result could be quite debilitating. Neither of the choices mentioned necessarily enter, as such, directly into the awareness of the educator.

Assumptions, as we have seen, provide the educator with predictions of the probable significances he will encounter in the external world. And, only through participation can he come to grips with the problem of externality. By experiencing the consequences of his participation he is able to ascribe significance to external situations.

The prediction on which his participation is based is constantly tested by his experiencing the consequences of actions. As a result his assumptions are either bolstered, modified, or completely rejected. The probability is changed in proportion to the unconscious weighting given to that particular experience, resulting in modified assumptions, modified predictions, and modified externalized significances. Toch and MacLean suggest that "Man, the scientist, or just plain man is in a continuing process something

like the following:

1. He senses inadequacies in certain of his assumptions. They don't seem to hold as well as they did in the past. This is problem awareness.

2. He tries to locate those aspects of phenomena except for which the functional activities in question would not exist.

3. He chooses those aspects he feels are most crucial.

4. He works out some methods for changing those aspects and experimenting with the changes.

5. He modifies his assumptions on the basis of empirical evidence" (16:75).

Yet, every time the educator participates in a transaction he may or may not test his assumptions. More importantly, it is the educator's ability to reflect on his actions that allows him to modify assumptions or to develop new assumptions. There are actions which do not lead to the fulfillment of his purposes; actions which result in surprise, anger, frustration, or an awareness of another way of defining the problem for himself.

Change and uncertainty then, become the guiding rules of nature. Any transaction he takes part in has some degree of unpredictability for which his past experience is a totally unreliable predictor. One can assume the educator is constantly faced with an over-riding problem of choice. One aspect of communication, then, is the creation of certainty out of uncertainty--truly an act of faith.

Part of the educator's sense of surety stems from situations in which his assumptions resulted in an adequate fulfillment of his purposes. In this case, his actions merely reinforce what he believes to be true. What happens, however, when the significance of an experience is not as expected? The educator may expect a student to have certain values, purposes, and abilities which he later finds out that the student does not have. Or, the educator may expect certain rewards for his innovative teaching techniques and discover that no one appreciates his effort. Thus, a problem or hitch results from inadequate assumptions.

As Ittelson states, "Every hitch is either the result of a failure to achieve a particular goal, that is, of inadequate 'how-to-do' predictions, or else the result of a failure to experience a hoped-for satisfaction resulting from an incorrect 'what-for' prediction" (8:36). Problems can be experienced as a frustration of our purposes. This lack of correspondence between externalized and encountered significances accounts for most of the change in man. For the primary function of communication is neither revelation of the present nor remembrance of the past; it is prediction of the future. As Kelley puts it, "Learning is modification of the organism through experience in such manner and degree as to cause it to behave differently under proper circumstances in the future . . . . The most important thing in anyone's externality is other people . . . . Since we build and are ourselves built by other people, we can see how great is our stake in them. The psychological function is developed

with people, and the quality of the psychological self depends upon the quality of the people out of which it is built" (10:251).

Before outlining the short-term recommendations, we will restate the assumptions of a transactional viewpoint. Some of these assumptions are:

1. The process of communication is essential to life.

2. Communication functions to enable a person to carry out his purposes.

3. A person creates a unique world of experiences since there is no revealed reality.

4. A person and his environment (i.e., objects, people, language) are not independent of one another.

5. Each person is a unique configuration of experiences, assumptions, and purposes.

6. A person participates in communication from his own unique point of view.

7. Communication is a process actively engaged in by a person.

8. Meanings are given to people, objects, sequences, and actions by a person in terms of his past experiences and his future expectations.

9. A person is constantly changed in and through his participation in the communication process.

10. A person participates in communication with others assuming some degree of correspondence among their experiences, assumptions, and purposes.

11. Most failures in communication can be attributed to an inadequate assumption about the correspondence of meaning among people.

12. Perfect communication is impossible since each person participates from a unique configuration of experiences, assumptions, and purposes.

13. Each person strives to increase the reliability and verifiability of his assumptions.

14. Knowledge does not exist in its own right.

15. Knowledge is what we know after we have learned.

16. Learning is modification of a person through his experiences so as to result in a change in future expectancies.

17. Problems can be experienced as a frustration of a person's purposes.

18. Problems exist only in people.

19. A person's major problem is to fit his environment to his communication and not his communication to the environment.

20. A person is constantly faced with the problem of correspondence between the significant aspects of past experiences which he externalizes and those significant aspects which he externalizes in his present encounters.

21. A person's self-reflexiveness is all important since most of his assumptive world exists on an unconscious level.

22. Man's major purpose in life is to increase the value enhancement of his experiences.

How would these assumptions affect research into the

problems of knowledge conception, distribution, and utilization? Research needs to be done on who are the potential users, their values, purposes, beliefs, and assumptions. From this investigation might emerge the aspects which seem to be problematic for people--not only educators, but students, parents, and other members of the educational community. Let us remember that people can put meaning into externalized knowledge only when they have something in experience and purpose to put into it.

With a re-definition of the potential user, and their information needs, an investigation into their communication systems should be undertaken. The popular media, both print and nonprint, might prove to be viable outlets for educational research. A medium should not be utilized for "just" the dissemination of knowledge, but for its full capacity to relate to the users' personal experience. For instance, for people who are constrained by their assumptions in accepting creativity by others, film could be used to show highly creative people at work, at play, at home, and so forth. The purpose in designing these experiences would be to help the user modify assumptions which are likely to be debilitating. It is assumed that the focus on evaluation of assumptions and on their modification is going to aid the user in inquiry.

If we assume that we can change the behavior of others only to the extent that we can design experiences which lead them to modify relevant assumptions, then devices such as simulations, games, and other role-playing techniques could prove useful. These common experiences allow the participants an opportunity to question their

purposes, assumptions, and the consequences of their actions. Further research into the viability and potential utility of these techniques is needed.

Research into the utilization of knowledge needs to be explored further. Criteria for evaluating a person as an inquiring system rather than a consumer of knowledge needs to be explicated. The usefulness of knowledge can be evaluated only in terms of a person's purposes within his problem-naming and problem-solving process.

References

1. Bentley, Arthur F., "The Fiction of 'Retional Image,'" Chapter 15 in Inquiry into Inquiries: Essays in Social Theory, ed. with introduction by Sidney Ratner (Boston: Beacon Press, 1954).

2. Birdwhistell, Ray L., "Contributions of Linquistic-Kinesic Studies to the Understanding of Schizophrenia," in Schizophrenia: An Integrated Approach, ed. by Alfred Auerback (New York: Ronald, 1959).

3. Bridgman, P. W. "Science and Common Sense," Scientific Monthly, July, 1954, 32-39.

4. Cantril, Hadley, The "Why" of Man's Experience (New York: MacMillan, 1950).

5. Costello, Daniel E., "Therapeutic Transaction: An Approach to Human Communication," Chapter 23 in Approaches to Human Communication, ed. by Richard Budd and Brent Ruben (New York: Spartan, 1972).

6. Dewey, John, and Arthur F. Bentley, Knowing and the Known (Boston: Beacon Press, 1949).

7. Hastorf, A. H. and H. Cantril, "They Saw a Game: A Case Study," Journal of Abnormal and Social Psychology, 1954, 49:129-34.

8. Ittelson, W. H., Visual Space Perception (New York: Springer, 1960).

9. Ittelson, W. H.and H. Cantril, Perception: A Transactional Approach (New York: Doubleday, 1954).

10. Kelley, E. C. "Education is Communication," Etc., 1955, 12:248-56.

11. Kilpatrick, Franklin P., Explorations in Transactional Psychology (New York: New York University Press, 1961).

12. Northrop, F. S.C., and Mason W. Gross (eds.), Alfred North Whitehead: An Anthology (New York: MacMillan, 1953).

13. Ruesch, Jurgen and G. Bateson, Communication: The Social Matrix of Psychiatry (New York: Norton, 1951).

14. Spiegel, John, Transactions (New York: Science House, 1971).

15. Thayer, Lee, "Communication: Sine Qua Non of the Behavioral Sciences," in Vistas in Science ed. by D. L. Arm (Albuquerque: University of New Mexico Press, 1968).

16. Toch, Hans and Malcolm S. MacLean, Jr., "Perception, Communication and Educational Research: A Transactional View," AV Communication Review, 1962, Vol. 10, No. 5:55-77.

17. Watzlawick, Paul, Janet Beavin, and Don Jackson, "Some Formal Aspects of Communication," American Behavioral Scientist, 1967, Vol. 10.

18. Whitehead, A. A. The Aims of Education (New York: Mentor Books, 1949).

ADDENDUM

BIBLIOGRAPHY ON PSYCHOTHERAPY CONSIDERING THE CONCEPTS RELATIONS AND COMMUNICATION, LEARNING AND EDUCATION FAMILY, AND COMMUNITY

Relations and Communication

Alexander, Franz. Psychoanalysis and Psychotherapy (New York: Norton, 1956).

Bier, Ernst G. The Silent Language of Psychotherapy (Chicago: Aldine, 1966).

Bromberg, Walter. The Nature of Psychotherapy (New York: Grune & Stratton, 1962).

Carkuff, Robert R., and Berdenson, Bernard G. Helping and Human Relations: A Primer for Lay and Professional Helpers (New York: Holt, Rinehart, & Winston, 1969).

Davis, John D. The Interview as Arena: Strategies in Standardized Interviews and Psychotherapy (Stanford, California: Stanford University Press, 1971).

Denzin, N. K. An Interactional Analysis of Psychiatric Treatment (Unpublished Ph.D. dissertation. University of Iowa, 1966).

Frank, Jerome David. Persuasion and Healing (New York: Schocken, 1961).

Harris, Thomas A. I'm OK, You're OK (New York: Harper, 1969).

Hoch, P. H. Psychopathology of Communication (New York: Grune & Stratton, 1958).

Jackson, D. D. Communication, Family, and Marriage (Palo Alto, California: Science and Behavior Books, 1968).

Jackson, D. D. Therapy, Communication, and Change (Palo Alto, California: Science and Behavior Books, 1969).

Law, S. G. Therapy Through Interview (New York: McGraw-Hill Book Company, 1948).

Lennard, Henry L. The Anatomy of Psychotherapy (New York: Columbia University Press, 1960).

Meerloo, J. A. M. Hidden Communion: Studies in the Communication Theory of Telepathy (New York: Garrett Publications, 1964).

Mullahy, P. A Study in Interpersonal Relations: New Contributions to Psychiatry (New York: Hermatige Press, 1949).

Mullan, Hugh. The Therapist's Contribution to the Treatment Process (Springfield, Illinois: C. C. Thomas, 1964).

Ogg, Elizabeth. Psycotherapy: A Helping Process (New York: Public Affairs Committee, 1962).

Parker, George V. C. Some Concomitants of Dominance in the Psychotherapy Interview (Unpublished Ph.D. thesis. University of Iowa, 1963).

Pearson, Leonard, ed. The Use of Written Communications in Psychotherapy (Springfield, Illinois: C. C. Thomas, 1965).

Polansky, Norman A. Ego Psychology and Communication (New York: Atherton, 1971).

Rogers, Carl R., ed. The Therapeutic Relationship and Its Impact (Madison: University of Wisconsin Press, 1967).

Ruesch, Jurgen. Communication: The Social Matrix of Society (New York: Norton, 1951).

Ruesch, Jurgen. Disturbed Communication (New York: Norton, 1957).

Ruesch, Jurgen. Therapeutic Communication (New York: Norton, 1961).

Schofield, William. The Purchase of Friendship (Englewood Cliffs, New Jersey: Prentice-Hall, 1964).

Slovenko, Ralph. Psychotherapy, Confidentiality, and Priviledged Communication (Springfield, Illinois: C. C. Thomas, 1966).

Snyder, William V. The Psychotherapy Relationship (New York: MacMillan, 1961).

Steinzor, Bernard. The Healing Partnership (New York: Harper & Row, 1967).

Sullivan, Harry Stack. The Interpersonal Theory of Psychiatry (New York: Norton, 1953).

Sullivan, Harry Stack. The Psychiatric Interview (New York: Norton, 1954).

Learning and Education

Barker, Lewellys F. Psychotherapy (New York: Appleton-Century, 1940).

Brammer, Lawrence M., and Shostrom, Everett L. Therapeutic Psychology (Englewood Cliffs, New Jersey: Prentice-Hall, 1968).

Corus, Rahe B. and Rabe, Peter. Psychotherapy from the Center (Scranton, Pennsylvania: International Textbook Company, 1969).

Dellis, Nicholas P., and Stone, Herbert K., eds. The Training of Psychotherapists (Baton Rouge: Lousiana State University Press, 1961).

Devereus, George. Therapeutic Education: Its Theoretical Bases and Practice (New York: Harper, 1956).

Dollard, John, and Miller, Neal E. Personality and Psychotherapy (New York: McGraw-Hill Book Co., 1950).

Eysenck, Hans Jurgen. Behavior Therapy and the Neuroses (New York: Pergamon, 1960).

Eysenck, Hans Jurgen, and Rachman. The Causes and Cures of Neurosis (San Diego: Knapp, 1965).

Eysenck, Hans Jurgen, ed. Experiments in Behavior Therapy (New York: Pergamon, 1964).

Garner, Harry H. Psychotherapy; Confrontation Problem-solving Technique (St. Louis: Green, 1970).

Goldstein, Arnold P.; Heller, Kenneth; and Sechrest, Lee B. Psychotherapy and the Psychology of Behavior Change (New York: Wiley, 1966).

Jersild, Arthur T., and Lazar, Eve A. The Meaning of Psychotherapy in the Teacher's Life and Work (New York: Teacher's College, Columbia University, 1962).

Jones, Maxwell. Beyond the Therapeutic Community: Social Learning and Social Psychiatry (New Haven: Yale University Press, 1968).

Perls, Frederick S. et al. Gestalt Therapy (New York: Julian Press, 1951).

Philips, Ewing L. and Weiner, Daniel N. Short-Term Psychotherapy and Structured Behavior Change (New York: McGraw-Hill Book Company, 1966).

Porter, Ruth, ed. Symposium on the Role of Learning in Psychotherapy (Boston: Little, Brown, 1968).

Riese, Bertha. Hear the Hurt Child (Chicago: University of Chicago Press, 1962).

Rogers, Carl R. Client-Centered Therapy (Boston: Houghton-Mifflin, 1951).

Rogers, Carl R. On Becoming a Person (Boston: Houghton-Mifflin, 1961).

Rogers, Carl R. Psychotherapy and Personality Change (Chicago: University of Chicago Press, 1954).

Shands, Harley C. Thinking and Psychotherapy (Cambridge: Harvard University Press, 1960).

Symonds, Percival M. Dynamics of Psychotherapy (New York: Green & Shatton, 1956).

Tate, George T. Strategy of Therapy: Toward the Engineering of Social Growth (New York: Springer, 1967).

Wanke, Georg. Psychiatrie und Pädagogik (Wiesbaden: J. F. Bergman, 1905).

Family

Ackerman, N. W., et al. Expanding Theory and Practice in Family Therapy (New York: Family Service Association of America, 1967).

Ackerman, N. W., ed. Exploring the Base for Family Therapy (New York: Family Service Association of America, 1961).

Ackerman, N. W. Family Therapy in Transition (Boston: Little, Brown, 1970).

Allen, Frederick H. Psychotherapy With Children (New York: Norton, 1942).

Balser, Benjamin H. Psychotherapy of the Adolescent (New York: International Universities Press, 1957).

Biggar, Jean. Psychotherapy and Child Development (London: Travistock, 1966).

Chance, Erika. Families in Treatment (New York: Basic Books, 1959).

Cohen, I. M. Family Structure, Dynamics and Therapy (Washington: American Psychiatric Association, 1966).

Friedman, A. S. Psychotherapy for the Whole Family (New York: Springer Publishing Company, 1965).

Holmes, Donald J. The Adolescent in Psychotherapy (Boston: Little, Brown, 1964).

Howells, J. G. Family Psychiatry (London: Oliver & Boyd, 1963).

Howells, J. G. Theory and Practice of Family Psychiatry (New York: Brunner/Mazel Publishers, 1971).

Isaacs, G. Team Conflict--A Recapitulation of Conflict in the Home (D.N.Sc. thesis at the Boston University School of Nursing, 1963).

Lorand, Sandor, and Schneer, Henry I., eds. Adolescents (New York: Hoeber, 1961).

Messer, A. A. The Individual in His Family (Springfield, Illinois: C. C. Thomas, 1970).

Midlefort, Christian F. The Family in Psychotherapy (New York: Blakiston Division, 1957).

Peck, Harris B. and Bellsmith, Virginia. Treatment of the Delinquent Adolescent (New York: Family Service Association of America, 1954).

Pollak, Otto. Integrating Sociological and Psychoanalytic Concepts (New York: Russell Sage Foundation, 1956).

Slavson, Samuel R. Child Psychotherapy (New York: Columbia University Press, 1952).

Weinreb, Joseph, ed. Recent Developments in Psychoanalytic Child Therapy (New York: International Universities Press, 1960).

Community

Alexander, Theron. Psychotherapy in Our Society (Englewood Cliffs, New Jersey: Prentice-Hall, 1963).

Bierer, Joshua, ed. Therapeutic Social Clubs (London: Lewis, 1950).

Chaplin, J. P. Systems and Theories of Psychology (New York: Holt, Rinehart, and Winston, 1968).

Cumming, John. Ego and Milieu: Theory and Practice of Environmental Therapy (New York: Atherton Press, 1962).

Deasy, Leila C. Persons and Positions: Individuals and Their Social Locations (Washington: Catholic University Press, 1969).

Edelson, Marshall. Ego Psychology, Group Dynamics and the Therapeutic Community (New York: Grune & Stratton, 1964).

Eliasberg, Wladimir. Psychotherapy and Society (New York: Philosophical Library, 1959).

Gesellschaft Nord-.... Situation and Personlichkeit in Diagnostik und Therapie (Basel, New York: S. Karger, 1968).

Gray, W. et al. General Systems Theory and Psychiatry (Boston: Little, Brown, 1969).

Jones, Maxwell. The Therapeutic Community: A New Treatment Method in Psychiatry (New York: Basic Books, 1953).

Mowrer, O. H. The New Group Therapy (Princeton, N. J.: Van Nostrand, 1964).

Pilowsky, Issy. Psychiatry and the Community (Sydney: Sydney University Press, 1969).

Rapoport, R. N. Community as Doctor (Springfield, Illinois: C. C. Thomas, 1960).

Schein, E. H. Personal and Organizational Change Through Group Methods (New York: Wiley, 1965).

Seward, G. H. Psychotherapy and Culture Conflict (New York: Ronald Press Co., 1956).

Symposium on Community Psychiatry (Madison: University of Wisconsin Press, 1966).

Whitaker, D. S. Psychotherapy Through the Group Process (New York: Atherton Press, 1964).

THE UNIVERSITY OF IOWA
IOWA CITY, IOWA 52240

Center for the Advanced Study of Communication
Area 319: 353-3259

Project: NCEC Knowledge Utilization Study

Research Memorandum #16:

"The Gulf Between Research and Practice in Education"

Originator: Robert B. Miller

Date: September, 1972

Distribution: Project Associates*

Research Assistants

NCEC Officials

Practicum Participants

Consultants

Contributors

Public Inquiries

THE GULF BETWEEN RESEARCH AND PRACTICE IN EDUCATION

Robert B. Miller *

Introduction

The long time lag between discoveries in research and the fruits of research in products and practices is not peculiar to institutionalized education. Hundreds of years elapsed between the discovery of the properties of gunpowder and its use in a cannon. Half a century elapsed between the discoveries of electromagnetic fields and the first electric motor. Dozens of years separated the discovery of the switching properties of semiconductive crystals and the invention of the transistor. Discovery which leads to the knowledge of phenomena and properties has no direct or necessary relationship to the application of that knowledge in the art of invention.

There is of course the gap between invention and cultural acceptance and assimilation. The concept of the computer as an automatic calculator was embodied in a device by Babbage a century before Von Neumann proposed the stored program

* Dr. Miller is a Senior Engineer in an IBM development laboratory, adjunct professor at Union College, and consultant to the American Institutes for Research.

device. Not only was the technology of electronics necessary to replace the impractical mechanical device of Babbage, but so also was it necessary to appear in an appropriate cultural milieu.

Even within highly competitive organizations such as the automotive and computer industries there are substantial time lags between appearance of research knowledge and inventions, and between inventions and practical application. A body of technology in the subject of rational management is rapidly expanding with respect both to business management and to "people" management, but the adoption of this technology, even when proven, is in terms of decades rather than months or years. It has been pointed out by Hunter (1969) in the aero-space industry that even individual and organizational success becomes a powerful reactionary force against further technological innovation. He advocates that after the successful completion of a highly innovative project, the innovators be retired so as not to impede the next generation of change. Yesterday's innovator is today's reactionary.

It should not therefore be surprising that a non-competitive industry which produces an undefined product considered a social necessity, enshrined in an aura of paternal authority

with a heritage from the church itself, should be somewhat less than bold and entrepreneurial in seeking innovation--except in expansion of territory and prerogatives. These latter may be in the nature of human institutions, so that in this regard any who are tempted to throw stones should be reminded that we all live in glass houses.

When a writer formulates a critique, he can be honest to his readers by declaring his underlying assumptions (to the extent that he is aware of them) so that the reader can sprinkle the right amount of salt in the right places. I have two major ones to offer. One is my belief in educational pluralism: there are many varieties of "good" curricula, "good" educational practices and "good" educational products. I must put good in quote marks because no well-defined, unequivocal criteria exist in education, at least as a pattern of trade-off variables, and I am not sure that there ever can be--although I believe there must be a continuous attempt to aspire and search for them. In any event, the assumption is circular: the absence of standard criteria justifies and requires a pluralistic point of view.

My second assumption is that innovation is not necessarily a good thing, or that conservatism is necessarily bad. A combination of moving inertia and static inertia--the flywheel idea--is likely to make practical and social sense. Some constraints must absorb faddism, the illusion that paradise is

right around the corner, and the threat of professional and technical anarchy. Unfortunately, educational practice can point to some disastrous fads which, although legitimate in the context in which the idea was developed, were dysfunctional when transplanted. Perhaps the well-nigh universal adoption of the "normal" distribution curve and the objective test--useful in selection testing for job situations where real-life criteria independent of the test itself could be used for validation--are examples still with us.

The practice of conservatism, as I would define it, is rational in the sense that it represents a position of "prove it" to an open and even constructive mind. I would like to distinguish this from the attitude of reactionism which in effect says, "I don't believe anything can be better than what I have or do or have done, and not only am I unwilling to try out a new proposal, I'm opposed even to your talking about it." This is of course a statement of very extreme position on a scale which can have many degrees. It is this attitude against innovation by individuals, organizations and the supporting public that is one major topic of this paper.

A summary of my argument runs as follows. In order to try to solve a problem one should attempt to understand the forces which militate against an idealized solution; thus one can

understand how far a practical solution can go, as well as what the solution might look like. The major basis for the abyss between research and practice is the difference between discovery and invention, and the gap between invention as innovation and innovation as a practice which requires creative collaboration from all participants, including those who adopt and directly apply the innovation. But the creative or innovative impulse although guided by technical insight is energized by the learned motivations. The major impediments to the innovative impulse in education lie in the culture of intellectual obedience and passivity that is embodied in the education establishment. Not only does it instill such passivity in its products, the students, but its practitioners are also among its victims. The opposite of intellectual passivity is the intellectual initiative. The operational structures which make for personal and professional intellectual passivity are thus the major obstacles to any program to deal with innovation, hence are relevant to the definition of the problem and the construction of a practical solution.

The objectives and communications in research, on the other hand, tend to be professionally parochial and thus either disinterested in practical outcomes, or self-interested where

a practical outcome may be proposed.

There seems little or no connecting ground between these islands except perhaps for the occasional crusader who may combine, in varying degrees, the technical, administrative, and political competence of the successful entrepreneur. The other factor, unreliable in time and content, is the process of cultural diffusion which risks being too little and too late.

Proposals for accelerating the rate at which research findings become realized in educational practice will therefore be directed towards (a) the content, evaluation and interpretation of research; (b) the role of development as a set of inventions that embody research discoveries in concrete models and exemplars; and (c) the role of the invention of mechanisms that increase the rate of adoption and diffusion by a subculture that is habituated to conservatism and reactionism.

Individual Conservatism

The understanding, acceptance and participative application of innovation has operational meaning ultimately at the level of individuals within organizations and institutions--where the latter may be defined sociologically as well as organizationally. In a previous paragraph I defined conservatism as

a policy, and reactionism as an attitude. In this and the following sections I may appear to be inconsistent because I will concentrate on that aspect of conservatism which is a manifestation of reactionism rather than rational choice policy. The participative acceptance of a proposed innovation (whatever it may be) implies some intellectual understanding of the innovation and its implications, both as to benefits and to costs--where "costs" is intended to have a very general connotation. But the understanding of a concept must be preceded by an "open cognitive door." That merely means a willingness to listen constructively to the proposal, and to the proposal maker, with a tentative or hypothetical acceptance in order to participate exploratively. This form of interaction requires both a motivational readiness and cognitive strategies which social and educational processes tend largely to eliminate in the child's maturational process in his social and educational environments.

As an advance summary, the forces which make for obedience make for the suppression of individual initiative, and the capacity for intellectual initiative is a necessary condition for the subjective "discovery" of the meaning of a proposed innovation--that is, of new ideas and new values. This result

is not necessarily attributable to a deliberate conspiracy by a collection of social institutions, but is rather a consequence of a perceived need for societal control, which means the control of "impulsive" behavior by child, student, professional person and citizen. The range of these impulses extends to cognitive initiatives which, habitually "controlled" by a process of non-reward or punishment, tend to atrophy.

What forces bring this about?--all influences which make for obedience and thus passivity to an explicit or implicit voice of authority--and an implicit voice of authority includes the individual's personal habit structures acquired through the reinforcement process. Let us suspend value judgments while we examine the processes which have benign consequences--at the same time that they have liabilities which are the principal concern of this paper.

Parents initiate the "socializing process," which is the control and management of the momentary impulse, sometimes by diversion but usually by suppression of the impulse. In spite of any prevailing social fad, the desirable child is the tractable child--which means obedient. When an individual is maintained under extended constraints, such initiatives as may remain will tend towards strategies for avoiding or by-passing the constraints as a first order of business. The

rebellious child (or citizen)is thus motivated first to break his perceived bondage, and only as a remote secondary objective, some constructive alternative to an arbitrary mere obedience. The rebellious child tends to be preoccupied with rebellion; the tractable child is merely passive or preoccupied with obedience--that is, the avoidance of punishment.

By and large, when the child is delivered to organized education in his fifth or sixth year, the process of obedience is extended from the social milieu to the cognitive and intellectual milieu. The vectors towards the achievement of obedience may be gentle or brutal, but tend to be omniprescent. He learns (more or less) to sit still for extended periods of time. His options for activity, mental and physical, are constrained. He learns the constraint of the school day, the organized weekly pattern of classes, the fifty minute class session, the authority symbol who represents and imposes a morality of right and wrong on cognitive behavior rather than joy in its mere happening. The child is <u>conditioned</u> to constraints of intellectual impulse, and without a diversionary (and rewarded) alternative the springs which give rise to the impulses dries up. Or the impulses are directed towards strategies of hostility and evasions of the constraints. The normal outcome to be expected is intellectual passivity and

a deeply implicit dependence on authority figures and permissable precedent. Because of the reward-punishment dispensing of these authority figures, obedience acquires a strong moral value, so that a sense of guilt may accompany any tendency to challenge it. The frustration-agression thesis of Miller and Dollard readily accounts for rebellious patterns in this context.

There is another pervasive device--exemplified both by our general mores and particularly in academic practices--of competition used as a motivational instrument, and as indicator of success. This has a variety of major liabilities for the creative intellectual impulse--the necessary spark to ignite the illumination of innovative ideas. Since the conditions of competition are controlled by the teacher, or educational institution, the more successful will be those who have been obedient to the academic conditions and requirements. The docile will be best rewarded if they are diligent in doing work that enables them to succeed at tests. The second liability at work in competition is that a means is found for controlling and directing the entire group who accept the "race." Criteria become standardized and enshrined in group norms, and the concept of cognitive success is that of a win-lose situation. The ranking scale means that if one

is higher on the scale, another must be lower. But only one can be at the top, and the rest must regard themselves as inferior.

The competitive notion has some other major liabilities for the development of innovative thought. It leads to a preoccupation by the instructional facility with the testing and evaluative process, so that ironically, instructional objectives are set in accord only with what can be reliably measured (see R. Mager on instructional objectives, for example, and this is a widely quoted contemporary point of view). It is natural to turn from reliability of measurement to objectivity of measurement of performance. Now it should be apparent that the simpler the behavior, the easier it is to test reliably. Spelling, grammar rules, historical dates--by and large, material that is governed by rule-following or dependent on rote memory--readily lend themselves to "objective" measurement in student response.*

Ideas, concepts and principles on the other hand, tend to be "rich" in the sense of cognitive ambiguity. Constructive thought occurs in an information context, usually unique, and therefore is not subject to objective measurement in the way

---

* A high order of skill in question formulation can produce objective items that sample from deduction or convergent problem-solving processes. My comments are intended to apply to tests that are used in classrooms, and not to the technical possibilities of objective tests.

that a spelling test or test in mathematics procedures can be objective. Since "objectives" for such content are not anchored readily in competitive objective testing models--with which in any event they are hostile--such material is not developed in classrooms. There are, as we shall see, other reasons. However, future teachers and educational policy-makers are among these students who are being trained in intellectual docility.

Now, the apologists for the socializing process rightly point out that self-discipline is a necessary condition to any constructive (as well as collaborative) behavior, and that self-discipline is acquired by transference of an externally imposed discipline to the control of the self. At this point we must ask, "What is the intended definition of discipline in this context?" Discipline may be regarded and practiced as control by repression and suppression of impulses, or it may be regarded as control by the direction and organization of impulses. I suppose that in principle everybody would agree that the latter is the proper psychological and social objective. But educational and social practice, by and large, tend to stifle the source of the intellectual impulses by beliefs and practices already cited. But even where they may survive in some hardy individuals, there is no clear

pattern of practice whereby the external mechanisms of discipline or control are transferred to the individual within the educational apparatus. The Ph.D. dissertation is perhaps the ultimate embodiment and test of student obedience to the rituals, pedantic constraints and political machinery of education as an institution. These constraints are well concealed under the paradoxical slogan "an exercise and test in original thought." The unexpressed rider would read "according to our rules for original thought." The dramatic exception to the generalization should be applauded, but not identified as representative.

More briefly, let us enumerate other factors making for intellectual conformity, passivity and reactionism in the educational milieu. Teachers are selected by administrators with the usual reasons for selecting employees: will they get their job done without making waves? In practical terms, this means will they accept the general constraints of the teaching environment--i.e., be docile to it. By this means the practices of institutions are preserved. The political and economic power of a variety of accrediting institutions impose another layer of constraints, meaning obedience or else--! The work environment of teachers and their administrators imposes, perhaps of necessity, a large pattern of

bureaucratic practices and procedures to be followed rather exactly with the combined objectives of "efficiency" and of protection of the apparatus against any kind of troublemaker. By definition, the intellectual maverick is a troublemaker. In practice, a "good" teacher is one who has few troubles with classroom "discipline" and whose students give test performances within the approved norms.

Pressures of competition do not foster discernible failures at the level of individual teacher, administration or school. Since experiments, by definition, can have only probable success, the fear of failure will stifle even an interest in experimentation. Furthermore, lack of training by educators in developmental experiments, and lack of history of personal success experiences in innovation or independent thought, means lack of a platform either in motivation or competence for innovative thought or for innovative action.

Finally, the anomalous role of the teacher in our society, plus the exercise of the authoritative role as "caretakers" of children and society, tends to create an atmosphere of institutional sacredness which is certainly not conducive to institutional change, or the contemplation of change and change machinery.

Organizational Conservatism

This discussion is bound to have some redundancy to a treatment of individual conservatism and resistance to innovation where organizational factors must operationally reflect. One might bear in mind, however, that occasionally an individual or collection of individuals, teachers or administrators or both, may overcome the constraints imposed by their backgrounds and become interested in generating or applying innovative thought to their professional environments. It is at this point that factors tending either to organizational support or to organizational constraint become operative, therefore significant.

The flywheel of traditional practice is difficult to change either in velocity or direction. The metaphor of wheel is also relevant because its cyclical movement is predictable and thus generally comfortable. The old-timers are usually in positions of authority to indoctrinate and control the newcomers, so that traditions not only of practice, but of belief and value are preserved.

Any academic institution--like any other organization--has administrative subdivisions which comprise not only technical entities but also political entities. A major purpose of

political entities is not only survival but territorial expansion of span control. Control implies prestige and influence, budget and a greater share of prerogatives and perquisites. Not the least of these is control of the curriculum content and "required courses" as well as the setting of standards and student "requirements." Preoccupation with influence, personal or organizational, is inconsistent with interest in innovation except as a material extension of influence.

The directors of organizations will be more sensitive to a general climate of approval and approbation than its other members. Since they must manage with inevitably scarce resources (time, talent, dollars, facilities, etc.) and depend on their environment for the supply of resources, they tend to avoid conflict with that environment and are likely to recognize, either intuitively or from unhappy experiences, that innovation--or even thinking about innovation--inevitably breeds conflict that tends always to overflow legitimate organizational controls. Thus administrators are sensitive and responsive to the large accreditation machinery, both formal and explicit as well as informal and implicit, which continuously grinds away at variations to normative practice and normative products.

In these respects, administrators must be and are realists. They depend on the good will of taxpayers and especially the approval of a complex of budgetary agencies for their survival. Thus they are directed, often by compromise, to a widely embracing common denominator of institutional practice, objectives and products. At least historically they have lacked the competitive spur of non-monopolistic industries which on occasion generate an entrepreneurial thrust which can be supported by an acknowledged expertise and budget for "marketing" the product--that is, creating both a social acceptance and a sense of want for the product or service. Rather than technical innovation that will inevitably tend to divide their actual or potential constituency, administrators will seek embellishments to the physical plant which is more readily and widely perceived and approved.

Another organizational factor that is looming large and powerful is the unionization of teaching staff and the de facto polarization of operating management and technical staff. It is possible, but hardly likely, that the traditional effects of unionization will not occur. The traditional effect will not be good news for innovation in education as manifest to the student. Traditionally the union increases the

"protection" of the large proportion of the work group with middle and lesser levels of ability and competence, usually at the expense of the highly competent. Thus seniority rather than "merit" becomes the basis for advancement and privilege. (Seniority is certainly far easier to be objective about than "merit.") The protection of a union membership must, perhaps not inevitably but with great probability, require the stabilization of practices and procedures, and of middle of the road criteria of competence. Since, at least traditionally, the union as an organization depends on a climate of overt strife with management, the innovative teacher or the innovative management must move through a ritual of resistance and strife for accomplishment of change. The would-be innovator will indeed seem to be lodged between the rock and the hard place. In any event, he is more likely to be concerned with allegiances than with technical change either in practice or objective.

In principle at least, innovation does poorly in organizations with large fragmentation, and especially where the fragments exist primarily on the grounds of incompatible objectives (of whatever kind) and hostility (whatever the basis).

Public Attitudes Towards Innovation

It is ironic that even if schools wished to change, the monster they have created would rear as a major obstacle to change. This is the public educated by schools. Since educational practice and environments have not encouraged independent thought, or the initiatives that might lead to it, the public by and large is unequipped to understand, much less evaluate, alternatives. At least in retrospect the authoritarian father-image tends to glow with sanctity, perhaps more because of than in spite of its grim visage. Because rarely has student or teacher been presented with alternatives (such as the joy of having and discovering ideas), "education" means school, and school means rules: when to be where, what to do, how to do it, the test as a measure of success or failure (not an index of degree in some kind of competence). School is where the teacher is bigger than you are, or sits higher. School is a collection of courses and collections of people, textbooks and classrooms where generally the dean or principal was seen person-to-person only when one was in trouble. School was where I learned what institutional life meant, and to be quiet and diligent; school taught me that there was some right rule for everything if I only knew who to ask for it. (Deci [1972]

has published some studies on work motivation that apply equally to study motivation: his findings emphasize the continuous value of "intrinsic motivations" as contrasted with extrinsic controls.)

These are personalized images and a poor substitute for a "representative sampling" of data. On a further personal note, I have addressed numerous parent groups, teacher groups, and administrative groups on a variety of topics ranging from the psychologies of learning to the capabilities, limitations and liabilities of automated instruction and find general support for this image, although I must acknowledge the possible influence of personal bias. It is my impression that, for various reasons, the public would be even more resistant to innovations in education--and the necessary trial-and-error accompanying innovation--than the members of the educational apparatus. And I suspect that the support of at least an enlightened and articulate (not the same thing by any means) segment of the public would be necessary for the adoption of more than trivial innovation other than the addition of facilities. The addition or change of facilities is only façade, and may preserve rather than modify a status quo just as a protective wall around a city preserves while constraining its borders.

Objectives and Criteria

At least theoretically, an innovation can be considered an improvement if it confers a benefit which some existing device or procedure does not provide, or if it provides some existing benefit at a lesser overall cost than the existing device. Even for marketable industrial products this simplistic decision model does not work too well for many reasons. Bookkeeper costs are not always the major or the most important costs of an enterprise. There are "intangibles" such as differences in level of supporting talent, or long term versus short term costs. "Benefits" are even more difficult to assess than costs, especially if the benefit has not previously existed in some comparable terms. "Comfort" is a benefit, but is only relative to some set of values. Benefits are most significant when they are deemed necessities in some prevailing scheme of values. The problems of assessment have inevitable circularities.

But when the product is a service--such as education--and the service lacks other than very general philosophical criteria as objectives which, in any event, can only be measured or assessed a generation hence, the difficulties in evaluating

proposed innovation intended as benefits become monstrous. This is particularly true when (as is always the case) the benefits impose penalties on alternative benefits. For example, let us assume that driver training for high school students reduces traffic accidents by those who participate. But taking a driver training course means the time cannot be spent in some other activity such as, say, the structures of thought behind communicative expository writing, or of practical semantics. The instructional cost for any of the alternatives may be equal. The choice must be from among alternatives where some are chosen and others abandoned.

As any manager of resources knows, or quickly discovers, all forms of resource are limited. Applying a resource to one commitment means the decision to deny the resource to other potential activities. Where the alternatives are between allocating a resource to a day-by-day commitment that is well-defined by its very presence versus a long term commitment with uncertain outcome, the preference is clear.

I am not implying that the mission of education can or even should be expressed in the equivalent of engineering design specifications. I would not, however, contest the suggestion

that more or less continuous attempts to do so will be highly informative to all parties to the educational enterprise, including researchers. But this would be a case where what was learned by traversing the route would be more useful than what one could expect from arrival at a destination. The process of attempting to define criteria for any kind of system is likely to be more fruitful than the product of the inquiry.

It is also likely that a pluralistic society should contain organizations that serve pluralistic educational objectives, so that a single measuring stick applied to all would be dysfunctional.

Unfortunately, the search for objectives is likely to be linked to curricula and knowledge products. Knowledge products obscure the perception that education should be viewed as imparting a broad variety of competences (other than vocational) and the educational process as consisting of favorable learning opportunity at the moment-by-moment level.

But it would be digressive to explore the problems and the philosophies of educational objectives and missions here. A comprehensive outline of the range of the possibilities is

contained in Bloom's Taxonomy of Educational Objectives published some sixteen years ago. The relevant point is that no unequivocal collection of mission statements at the operative level (as distinguished from the philosophical level) is explicit, communicable, "testable" and widely accepted by the educators, students and public as goals. Whether or not it is feasible to generate them and gain acceptances is also beside the point. Their non-existence prohibits hard-boiled, objective assessment of innovative proposals.

The qualifier here is on proposals that may increase the efficiency of whatever is done today. An instructional device that teaches typing skill in half the prevailing time is clearly desirable, unless its cost takes away unduly from resource (such as dollars) needed for other purposes. Unfortunately, devices usually improve efficiency of the simpler operations and goals in education--those which are more easily programmed because the operation and the criterion are subject to mechanical rules. I should probably be tentative about such assertions because the capabilities of information processing systems (computers) are just beginning to be realized and their economic and technical availability to the computer layman is approaching but not present now.

The great danger in labor-saving devices, however, is that no labor will be accepted that cannot accomodate to the device. This is the kind of tyranny imposed by the "objective test" on much educational practice so that what is taught, and especially what is learned, is only what is susceptible to multiple choice answers which are mutually exclusive. This tends to rule out productive and creative competences--what Guilford (1967) calls "divergent thinking"--in favor of "facts" and mechanical and deductive procedures where ambiguity is low. The labor-saving device is indeed a beguiling trap to initiative. It invites laziness, and repels a reexamination of the purpose of the task in which labor is saved. One may come to dislike toast, but continue eating it because one owns a toaster that is too expensive to throw away.

Commentary

Up to this point we have built up a formidable array of difficulties besetting the motivations, competences and resources in the educational milieu for interpreting and applying possibilities for innovation. If the picture for innovation seems bleak, it is possible to take comfort in the fact that the machinery exists and, after a fashion, is running. Others may perceive evidence of change impending in campus

unrest (now subsiding), new names for courses, closed circuit TV, open classrooms, education "accounting," and so on.

Let us now turn to the other side of the abyss: what does research landscape reveal? Are profound insights and phenomena and techniques blooming and dying in a wasteland of neglect?

Problems in Research Content and Communication

Research potentially applicable to education is performed in a variety of subject matter domains. There is that body of applied research published under educational titles. The Educational Resources Information Center (ERIC) bulletin offers about a thousand citations and abstracts a month. The text of these abstracts alone extends to 150 large pages of 3 column, 6 point type. This index includes only reports published as documents. But other fields of potential relevance include the psychology of learning, developmental and maturational psychology, clinical psychology, linguistics (a rapidly growing field overlapping psychology and extending it into the cognitive domain by such researchers as Chomsky), sociology and anthropology. And indeed there may be others. These are, in the main, fields that do not deal with educational

subject matter content such as physics, mathematics, literature and criticism, and so on. I am confining reference to research of potential significance to education as a discipline or technology.

Research literature is not browsed effectively; either what is examined must be studied or its content is worthless. It can be browsed only with the intent to discriminate what will be studied or ignored. This also applies to abstracts. Even a selective reading of the ERIC abstracts (a fragment of the field or relevance) would require better than four hours a month by a reader who was familiar with the various jargons of the fields of research.

Being "well-read" in the research literature would imply that a scholar spending ten hours a day, five days a week, four weeks per month might have read say, one percent of the available literature of potential relevance. How much he would retain is open to question.

The sheer volume of words is an impediment to professional literacy in educational research. Unfortunately, asterisks do not automatically separate the kernels of wheat from the chaffstorm which, in any event, might depend on the interests and acumen of the reader. Parenthetically, this may be the

harvest reaped from the academic policy of publish or perish, a policy perhaps too generously abetted by none too discriminating government grants. (See for example Green's "The Educational Entrepreneur" [1972] for an appraisal of this problem.)

"Basic" Research

Let us sidestep the meaning of "basic" as contrasted with other research by putting the term in quote marks. Its synonym is "fundamental research." This is the attempt by the behavioral disciplines to follow the model of the physical sciences in determining those fewest variables in a phenomenal domain which account for all of the variability observed in those phenomena. Since different forms of observation and observing instrument reveal different phenomena, not necessarily correlated with each other, epistemological difficulties develop. The study of behavior of organisms is the study of systems, and it is possible that a science of organisms as systems may require a different reference model than that which has been successful in the physical sciences.

In any event, what to one school of behavior scientists may be perceived as fundamental variables and models is regarded by other schools as superficial. In psychology a

fashionable "model" which generates a body of research tends to last about 25 years. This is probably a healthy sign in a discipline that lacks reference orderliness in measurement: absolute scales such as centimeters, grams and seconds or a periodic table of the elements.

In general, basic researchers in behavioral science seek for properties and relations among properties in organic behavior. Frequently the intact human is the organism from which data are extracted. In the attempt to identify properties in the "pure" state, the organism is placed in a highly artificial (psychologically sterile) environment. Theoretically, this simplifies the management of controls. Since the generalization of the findings implies that the variable is independent of interaction with other variables, the failure of this assumption leads to improper, or at best uncertain, generalization of the findings. (Chapanis [1967] has already identified some major factors making the gap between the behavioral laboratory and the application of laboratory findings.)

A few difficulties in the use of laboratory findings in addition to artificiality may be summarized. Findings are concerned with the behavior of aggregates of

individuals. The large variance that remains after assignment to the experimental variable is treated as an experimental annoyance and consigned to the statistical wastebasket. At least ideally, education is concerned with individual variations in learning phenomena, as well as with aggregates of individuals. Studies performed by Stolurow some years ago at the University of Illinois showed an overall gain of an experimental group that learned by programmed instruction as contrasted with controls. But when he differentiated the brighter and generally superior students (on independent criteria), he found that they learned no better, or slightly more poorly, by programmed instruction. The mediocre and poorer students (of whom there were of course a higher proportion than the abler students) were the ones who profited from a controlled pattern of instruction. Better students may be better, in part, because they are able to impose their own learning structure on a body of material. The conclusion opens the possibility that instructional effort might better be spent on providing the mediocre and poorer students with abilities to structure a learning problem than to provide that structure artificially by "programming" it for them.

This hypothesis would not appear had there not been a concern with individual differences. The study is memorable partly because of its rarity. It justifies a proper skepticism and caution on laboratory findings--a caution by the way which is somewhat more likely in the scientist in role of critic than the non-scientist.

Reports of laboratory findings are expressed in statistical terminology that is easy to misinterpret. "Significant difference" in scientific jargon means a statistically "reliable" difference--one not likely to be the result of chance sampling variation. To simplify a point, let me offer a ridiculous situation. Every individual in group A comprising ten individuals is measured as 59.98 inches tall. Every individual in group B is measured as 59.99 inches tall. Assuming a single large population of mixed heights, there are only 2^{10} chances that all of the shorter individuals would be found in one group and all the taller individuals found in the other group if selection was random, that is, made by chance. Now 2^{10} is an impressive number: one chance in over a thousand if no selection factor worked to put the shorter in one group, the taller in the other. The conventions of the behavioral scientist call this a "statistically significant" difference, meaning it is unlikely that chance alone

could account for the difference between the two groups. Unfortunately, the jargon and careless editors permit researchers to shorten the expression to "a significant difference in height was found between group A and group B."

Characteristically to the researcher, the fact that the difference was only 0.01 of an inch is irrelevant to him, and in some cases he may not even publish what the actual difference was. These conventions permit of course much hair-splitting even among researchers; they are a deadly trap for the general reader, and especially if he reads only abstracts or the conclusions by the authors without examination of the raw data. Very small differences in absolute magnitude between experimental and control groups may readily imply that even small changes in the experimental conditions could nullify the effect of whatever variable was named as making the difference. Rarely do laboratory inquiries yield large practical differences, where "practical" means a difference that would still be usefully large in a daily life situation where the carefully designed conditions for the phenomenon were not possible.

Let us take a case in point. If one were to ask a professional experimental psychologist who specialized in

learning theory for a research finding that was important for application, he would with high probability cite the "benefit of spaced versus massed learning." "An hour spent in study will result in better learning if distributed over six ten-minute sessions than spent in a single hour long session" is a statement of the principle. Perhaps hundreds of studies have been conducted on these variables. As in other behavioral studies, the differences between experimental and control conditions rarely are dramatic, and never manifest universally by all students: there are overlapping distributions between the alternative learning conditions. Most of the studies have used nonsense material for learning; the value of learning a content by distributing practice with extended time intervals intervening is less pronounced where the material is "meaningful" to the student. It is conceivable, if not demonstrated, that highly relational material might be virtually unlearnable by distributed practice. Furthermore, since laboratory studies rarely carry learning beyond preliminary stages--from the viewpoint of skilled competence--it is uncertain whether the same principle of distribution would apply, and there is reason to believe it would not. Interpretation of the research literature is confounded by the fact that rarely are studies with "no

differences found" reported, so that a highly biassed reporting of the phenomena will be represented in the literature on the topic.

So how is this well-tested principle to be used in designing an educational regimen? One reads in other parts of the research literature about warm-up requirements, the need to establish student "set" or the instatement of an information context in the operator's thought processes. To this we add the variable of meaningfulness, and there another entire dimension to the problem appears. This is identified in research as "whole-versus-part" learning. It has its own variety of variables. One could add indefinitely to this melange of research variables. (Occam's razor has not found its way to the behavioral sciences.) Turn now from theoretical variables to practical matters in the control of distributed practice. How much content to distribute over what time intervals? How to find the old material? Shuffling of books and papers in the process of returning to a previous subject matter; finding one's place in it, and so forth. The control of learning sequences possible by computer may of course make practical the application--and test--of research findings in ways that are otherwise impractical. This is a case where implementing a finding depends on other technical innovations.

So the difficulties in applying the findings of so-called "basic" behavioral research boil down to the impossibility of telling from the research data how important the variable may be in any or all real-life learning situations and to real-life learners, and real-life stages of learning. Nor does research specify how to estimate the value of one variable in the context of other variables in the learning conditions. So the would-be designer, examining the research literature, lacks a basis for estimating either importance or relevance of the research variable to his instructional problem. Nor is he informed of means for incorporating the variable concretely in an implementation. One could hardly find a more completely discouraging relationship. Rather parallel problems exist between research reported from physics laboratories and the incorporation of research knowledge into engineering technologies--the difference is a matter mainly of degree. Knowledge about properties and phenomena is not equivalent to skill in the arts of design with those properties.

On rare occasions, a perceptive and creative individual tries to interpret and develop a picture of a subject matter from its research. R. M. Gagne's The Conditions of Learning represents, in my estimation, such an example. This work is

intended as a bridge between the research literature and educational practice. Fortunately for educators, Professor Gagne erects a coherent framework of ideas which, as such, extends very substantially beyond the data that completely justify such a framework. His scholarship and his own patterns of research enable him to make bibliographic citations which make his prescriptive models plausible as well as professionally respectable. But the value of the work lies not in his reporting of data, but in his particular synthesis of large collections of studies, his particular choices of important variables that are practicable to manage in the educational milieu. The book however is far from a how-to-do-it specification, at least at the level of the average classroom teacher or curriculum developer, although it comes closer to such a specification level than any other work with which I am familiar.

Professor Gagne has actively collaborated in putting his formulations into concrete practice in the form of instructional materials for students--and by such examples, in the instruction of teachers. He has been a major contributor to the project sponsored by the American Association for the Advancement of Science called "Science--a Process Approach." Thus as a professional he plays the role of researcher,

interpreter, practitioner-designer. I will propose later that an attempt should be made to sponsor the development and activities of a class of professionals of whom he may be cited as a prototype with Dewey, Piaget, and Bruner.

Unlike science, which is supposed to quest for organized truth, technology is tested by such pragmatic criteria as workability, practicality and benefit. It is therefore essential that technology recommend practices and submit principles and prescriptions that go beyond experimental data. There will be instances in which the prescription may be faulty, just as on occasion an excellent medicine may have unpleasant side effects. If on balance, however, the principle or model is useful and confers greater benefit than would have been attained in the absence of the principle or model, it is "good." This pragmatic point of view seems difficult for many specialists in experimental science to accept--although theorists and systematists and philosophers in science frequently do so in their own formulations and criticisms.

Science deals with abstractions: the derivation of variables, parameters and conceptual models of various kinds. Technology--and I would call the practice of education a technology in this sense--deals with the concrete embodiment

of objects and purposeful processes. Whereas science consists essentially in discovery, technology consists primarily in invention and design directed towards utilitarian purpose tested by value criteria. Design is always a large pattern of compromises, tradeoffs among values, and between values and costs.

The designer, technologist or artisan may be guided in part by knowledge of the findings in science, but data or conclusions from data never designed a cathedral or taught a course. (The fact that the creation of a scientific hypothesis has psychological kinship to the creation of a design concept is a side issue.) It is therefore not only conceivable but likely that a scholar with complete knowledge of the psychological research literature would be more inept than a teaching aide or housewife in framing and instructing a course in, say, spoken French or horticulture. The scholar would probably be useless even in proposing the mechanics of instructional technique. On the basis of self-selection of a career path, there is reason to suspect that if the scholar were also an experimental researcher in the laboratory, he would probably be quite inept in framing a practicable evaluation of the course of instruction.

These points are not barbs for the scientist--rather they are intended to emphasize that a competent shoemaker is not necessarily a competent baker, nor even a tanner of hides. In this there is warning. On occasion a scientist, brilliant and successful in laboratory work, may perceive the entire world as a mere extension of the conditions and controls he is able to manage in his laboratory environment. He may be a convincing crusader, partly because of his persuasive demonstrations of control of behavior fragments in a variety of species of organism from flatworm to human. The effectiveness of the control strategy may be so persuasive, even to intelligent audiences, that the following question does not get asked: "Will the application of the technique dictate the limits of achievement or even the consideration of purposes for achievement?" Especially in education, it would seem dangerous to accept the proposition that educational objectives should be limited to what a given control device permitted to be learned. This is captivity to the tool, rather than tool as an instrument for purpose. Every profession has these beguiling snares but education is peculiarly vulnerable--again because of its pluralism (or vagueness) of

purpose and objective. When one is uncertain or confused one tends to be gullible. In my point of view, the possibility of universal standardization, including even the standardization of useful principles of instruction and learning, is one of the major threats for the education of a free society. This threat, as well as great technical promise, is contained in the programming of computers. Growth is possible (or at least likely) only in open systems. Nevertheless, systematic research on the educational process, the educational product and educational content will probably be practicable only when the massive data collection and data reduction capabilities of computers are used to generate instructional input and record instructional output in "live" activity as contrasted with artificial laboratory research.

Applied Research Programs

The New Math program developed by the School Mathematics Study Group under Edward Begle and associates is an example of how large change can come about in a decade. Strictly speaking, it was a development program rather than research. It had the leadership talent and resources to achieve that critical mass necessary not only for survival but penetration

and acceptance. It was timely, in that it coincided with resurgence of American interest in technology based on the Sputnik incident. The program was comprehensive of a substantial subject matter domain: arithmetic, logic and mathematics. An interlocking series of graded textbooks was prepared. Perhaps the most significant factor of all, major efforts were made to indoctrinate and instruct teacher cadres who passed on instruction to widening circles of teachers. The program was large enough and apparently powerful enough to achieve actuality even though a substantial number of teachers may never have understood the concepts they were trying to teach. (This is an example of why a new idea in technology must be so good that even if it is degraded to a percentage of its potential, it is still better than an existing alternative.)

Whether or not the New Math is a good thing for education is beside the point here. It was a successfully run enterprise, and is cited merely to suggest how an innovation as a concept can become rather rapidly a general reality. A decade is a short time for such an achievement.

Clearly it was brought about by a dedicated team of varied specialties including the ability to get and maintain substantial

funding, and a competent management in the administration of a development enterprise. It must also have had awesome expertise in public relations: the kindling and spreading of interest and identifications. There must have been powerful antagonisms arrayed against it.

The New Math was primarily an attempt to restructure the relationships among arithmetic, mathematics and logic in a way intended to enable the interplay of understanding or conceptualization of principles and the procedures that are logically consistent with such conceptualization: in other words, to substitute--or at least support--rote learning by concept and principle. It is truistic that creative thought will more likely emerge from a knowledge of principles than rote knowledge of practice. So it can hardly be thought of as the exemplification in practice of research findings. This is intended as no criticism of the program.

It can be shown that science often follows art. What is known in practice is rediscovered in the laboratory. But the laboratory may also show that the assumptions underlying a practice are either false or must be severely qualified. Thus Thorndike showed by laboratory studies the fallacies in the notion of "mental disciplines"--that exercise of "reasoning" in one form with one kind of materials will spontaneously transfer to other forms and materials. The mental discipline notion has yet to be completely dispelled. (Unfortunately for the example, some recent research in "learning how to learn"

and other inquiries into cognitive strategies strongly suggest some high level transferabilities which now require a modification of the Thorndikian conclusions but these modifications do not return us to the mental disciplines notion.)

Another substantial program is called Science--a Process Approach. It has been conducted under the auspices of the of the American Association for the Advancement of Science and been active for more than half a decade. It represents both a curriculum development and the incorporation of cognitive models of behavior based on psychological research. It is perhaps significant that much of this research, although reported in prestigious psychological journals, was conducted with meaningful materials that resembled archetypes of classroom problems to a greater degree than they resembled traditional laboratory subject matter. Here, too, the program consists of the development of course materials, learning aids and instructional procedures: the full set of materials for instruction with learning content embedded in teaching/learning techniques based on research references. Not the least factor was instruction of teachers. After pilot testing,

workshops were conducted and participating teachers often accepted assignments for further participation and further developmental effort. These were seeds for still further proselytizing and a continuing effort of extending identification with the program. Although its adoption is less dramatic than that achieved by the New Math, its acceptance may be all the more genuine. It is difficult to assess whether the program has to date achieved the mass and momentum that would survive without an active centralized sponsorship and dedication.

Programmed Instruction

This is a concept directly rooted in psychological research, initiated by psychologists and during its earliest years almost solely developed by psychologists. Its guiding principle is some variation of "reinforcement theory." Its history over the fifteen or so years of its emergence into the public eye has been spotty. It was heavily oversold by its enthusiasts who tended to view its potential as more or less universal for all educational subject matter and objectives. The development of courses became commercialized perhaps earlier than was healthy for the maintained growth and perspective essential to an emerging technological instrument.

About 3,500 programmed texts are now commercially available. In my opinion, it was regrettable that PI seemed to attract few if any great teachers to lend their imagination and broad viewpoints of educational objectives not only to the enhancement of the technology, but also its proper integration into educational systems. Indeed, the internecine bickerings about procedural mechanics appropriate to programmed instruction quite eclipsed an interest in the communication arts of generating and transmitting subject matter.

It is tempting to critique PI with a list of the limitations in the practice (if not the principle) of the concept. Its major instructional limitation is its assumption that all learning in kind and subject matter is best made as an assemblage of chunks like the building of a mosaic. Much material that is useful to learn and use depends on the building of progressive context, rather than an accumulation of elements, and is most useful when organized and structured. Ausubel (1968) discusses these factors in learning.

In any event, programmed instruction did not find a way of integrating itself into the educational milieu and institutional fabric. This may have been due not only to its

limitations as perceived by the educational establishment, but perhaps more importantly because it provided no clear roles for the incumbents already in it. So it reached a plateau in the middle 1960's. It may revive to grow again when it couples with additional educational principles, or when it finds some technology more congenial to it than page-turning, or page-turning devices, or when its organizational role in the teaching establishment becomes integrated with other roles in that establishment. For better or for worse, teachers regard themselves as the primary instrument for teaching and, for better or for worse, teaching tends to be regarded by the educational establishment as the reciprocal of student learning.

I hazard the guess that any technology, however altruistic its concern with student learning, should be primarily addressed to the teacher and teacher identification, participation and self-realization (according to whatever role is perceived) if it is to survive more than locally. This may indeed be putting the cart before the horse, but this is institutional realism, at least as it exists now. (An entirely parallel problem exists in attempts to introduce rational management techniques into business, industry and the government.) Any perceived threat to the classical self-image of teachers will be overwhelmed by resistance.

The Process of Research and the Process of Development

The New Math, the program called Science--A Process Approach, and programmed instruction are examples not of research but of development. Development is putting "knowledge" into practice; it is therefore an art, even though a disciplined art. If technology is a body of guiding rules for design, it has meaning primarily in the objects that result from design.

The documented arrays of knowledge existing as abstract parameters and variables in research libraries therefore must move through another creative process before they are incorporated into real products and purposeful procedures. Design always requires a moving process of making tradeoffs and compromises, and a good design reflects the insights of the designer at least as much as it can reference any library of data. The abstract models of science are no more than a highly elastic scaffolding for the designer who builds to a pattern of purposes. This metaphor is certainly applicable to the communication arts which depend for meaning on human recipients and responders, so that structure and content are inseparable except to artificial analysis.

More to the point, it is unrealistic to expect practitioners--such as educators--to convert the results of research findings directly into practice. It may be unrealistic to expect any but a very few even to perceive the possible relevance of laboratory findings to their work or milieu. It is realistic to expect a capability among educators at large to assess, in degree and according to their special interests, a tangible development of what I would like to call an "educational subsystem" as an entity. In itself, closed circuit TV is a gadget. In order for it to properly qualify as a subsystem it must have the characteristics whereby it can be assimilated into the day-by-day planning, activities, movements, objectives and purposes that are considered "normal" among all the parts of the institution. This must imply active participative roles, including constructive initiatives, by a sufficiently large group of people in the organization to maintain supportive emotional identifications. The gadget cannot merely be a canned, off-the-shelf entity used and extolled perhaps by a few "radical" enthusiasts. If these enthusiasms are mainly a rejection of their environment or usual role in that environment, the interest will be short-lived.

A subsystem includes a collection of interacting purposes, tools, procedures, incentives, roles, guides and operating examples or models. Its scope should be large enough to engage the participative activities of a sizeable proportion of the staff in an instructional organization. Planning must include--and simplify--storage, bringing out from storage, warm-up, what to do in case of contingencies (something going wrong), maintenance, return to storage, extension of application, scheduling and integration with existing schedules, operations and purposes. This is integration as perceived by the educational staff. As perceived by students, the integration of a facility for learning will at least in part depend on their interpretation of acceptance by their teachers. If experience in training devices and procedures is applicable to education, then emotional rejection of a procedure or facility by a teacher will almost automatically be accompanied by rejection by the student. The converse is not necessarily true: teacher acceptance does not ensure student acceptance.

What is true of a commercial product is also true of innovative ideas and techniques. Their success depends on two classes of expertise. One is directed towards the technical solution. The other, equally important expertise, is

directed towards the "social" solution, the problem of acceptance. Even within a large industry dedicated to technical innovation which maintains its own research organization and production, this process is at work. It is recognized quite explicitly that a "good" discovery or development is one that is "sold" into adoption, and almost never does this happen spontaneously by the publication and dissemination of reports. Extraordinary promotional campaigns, including power politics, are mounted within and between organizations for support and adoption. The road to oblivion is paved with golden discoveries that were not properly promoted. Promotion is persuasion, a play on emotions and motivations where rational logic and empirical data are used as devices. This observation is not rooted in cynicism, because empirical data always imply some selection process--as manifest in statistical summaries, for example--and thus are incomplete, even with the most altruistic and "objective" intentions. It requires a human inventor to affirm that he "can make the principle work"!

So the gap between discoveries and findings in research and their application in practice is bridged essentially by the process of invention--what I have called development.

An example may clarify. Let us suppose that a modest body of inquiries into the learning of a body of material shows that providing the student with an "idea map" or conceptual picture of what he is going to learn, preliminary to his grappling with the details of content and procedure, enables him to learn more rapidly and better retain and transfer his learning than when such idea maps are absent or appended to the body of the subject matter. The investigators are likely to have used rather artificial subject matter in order to simplify control of secondary variables and thus hopefully to secure a wider generalization of the results. (This assumption is being occasionally challenged these days, but the practice generally prevails.) Furthermore, in order to obtain greater "objectivity" in the student responses, the material is chosen so that test answers can be unambiguously evaluated and graded. This implies the objective test, e.g., multiple choice questions. This requirement in turn requires either rote factual or procedural operations or mental operations primarily of the convergent type--that is deductive. The archetype of "problem solving" and "reasoning" is treated as deductive logic such as in arithmetic and logic. So the classroom teacher who would like to apply the research findings to, say, his presentations in a history course, or English literature criticism, is at a loss

for a useful model, or even for assurances that the findings apply to his subject matter and teaching/learning objectives. Presume that, nevertheless, he decides to try out the principle. He prepares what he considers are "idea maps" and "lead-in concepts" and "cognitive organizations." The instructional success of this attempt will clearly depend far more on his expertise both in culling and formulating the content of the "cognitive organization" and in communicating it, though it will depend on the principle itself. Failure may not invalidate the principle except as manifest in his implementation.

Like any other professionals, researchers develop a feel for their subject matter, tools and materials on which they work: i.e., human subjects. They will therefore tend--perhaps unconsciously--to select a combination of those factors and settings that will be favorable to their hypothesis. This makes transposition of the findings into different contexts very risky. Development and design avowedly select the pattern of factors that will, taken together, most probably work: that is, achieve the objective for the design hypothesis. But here, too, for the same reasons, generalization is risky. Pilot testing--the engineering equivalent

of bench testing--is the only recourse for validation. But validation assumes that someone has taken the time, effort and risk to create something that is validated. This time and effort will not continue to be spent by individuals who have experienced a pattern of failure in their attempts to put a research principle into a developmental practice.

Commercial Products

Perhaps because education is an 80 billion dollar a year enterprise, it is attractive to entrepreneurs. Many of these may have academic credentials and their work may stem from altruistic professional motivations. But a marketable product must yield to the tyranny of costs in production, testing, distribution, and especially of promotion. Thus there is a high variability in the quality of the product which gets into the competitive market, and the promotional tendencies (not generally under the control of the professional who designed the product) naturally emphasize the desirable and deemphasize the limitations and liabilities of the product. Slogans can masquerade as operative principles, and can be the basis for fads. It is tempting to believe that someone has discovered magic and put it into an easy-to-open package.

Behind a fad may lie a legitimate principle which is obscured by the appearance of being an easy formula. When an educator, however, has seen a number of fads come and go, he must become disillusioned. If the product has been sold as a "scientific discovery" he must become cynical about scientific discoveries which he is ready to leave to the naive juniors in his profession.

So we come full-circle back to the problems of motivational resistance to innovation even by those who have briefly essayed into new fields.

Summary of the Gulf

We have viewed a panorama of the multiple factors which impede the rate at which research findings influence and create innovation in educational practice. We have examined the acquisition of conservatism at the level of individual educator, educational organizations and institutions, and of the public environment in which these individuals and organizations exist. The absence of goals for education sufficiently well defined to provide operational guides to professional and institutional achievement, as well as for decision criteria, may be used to justify a conservative--as well as any other--attitude.

The sheer magnitude and variety of research potentially relevant to educational practice discourages attempts by the non-scholar to "keep up with what's going on." Furthermore, much research is conducted in artificial environments with artificial tasks and possibly on assumptions irrelevant to the educational milieu. The communications of research findings obscure practical evaluation of the importance of the experimental variables even in their own setting, and make translation into educational settings difficult or impossible. It is rare that a competent scholar undertakes the job of evaluating and synthesizing the research domain, and develops a workable conceptual model that is even indirectly applicable to, say, a course of instruction or a single session of instruction--whatever the media may be.

Discovery of phenomena and variables generates knowledge which in turn must be translated into inventions of products and practices that become the content and procedure of education. Rarely does this development produce what was called an educational "subsystem" which includes the role definition of the human teacher as integral to the rest of the developmental product. It is also rare that a developmental product incorporates innovations explicitly based on a broad base of research and inquiry. On occasion, developmental products

appear to be based on a very narrow platform of specialized laboratory technique. In some cases these developments may be evident as commercial products which even with respectable origins have the liabilities of promotional oversell and consequent disillusionment in the would-be innovator who has been gulled.

The Nature of the Bridge

Assume that we are concerned with quickening the pace whereby research results in the laboratory are realized in educational practice. If the foregoing analysis of the problem is valid, the nature of the accelerators is more or less evident. A realist, however, would have modest expectations for achievement in the light of the vast machinery not only for conservatism, but the fighting mood of reactionism. I can only identify the various components which I believe can create the bridge. But this is admittedly a great distance from preparing a realistic blueprint for implementing what is identified.

Research Interpreters

The capabilities of a research interpreter must extend beyond that of abstracter and summarizer: he must also be a competent systematist. This means he will create models

that will be slanted according to his predispositions, but if it hangs together a slanted model will be better than none at all. The model must be so expressed that it represents an entire instructional subsystem. The description of the structure of the subsystem should enable the intended user to make practical decisions both on the selection and organization of subject matter content, as well as about procedures and communication formats that make up the vehicle for learning. If the model is to be actually applied, it should be liberally sprinkled with examples which represent the decision and design process at work as well as their rationales. Any practical instructional procedure intended to guide the design process should be explicit about what the designer may have to do by-guess-and-by-gosh rather than figure out by interpreting a rule or principle. Hopefully, the interpreter will take a broad enough view of educational objectives to be able to suggest the regions where the model is ineffective or even contraindicated.

The arts of communication could profit from a better understanding about developing and expressing exemplars that will increase the depth and breadth of understanding of a procedural principle. The art of doing example design

could be enhanced by a tested discipline. This aside is made to denote the interpreter's need for communication skills quite different from those he uses in communicating with his research colleagues.

This kind of interpreter--who will necessarily "go beyond the data" if he is to prepare any meaningful and useful messages--will tend to be regarded by his scholarly and pedantic colleagues as a popularizer, whatever his previous academic credentials. He must therefore have incentives that will ease his endurance of their contumely. His professional position will be anamolous, being neither respectable researcher who collects and exhibits data, nor (to his parent profession) a successful, even though somewhat less respectable, consultant who works for a fee. He will therefore need identifications with an institution that has scholarly respectability and/or a substantial development program in which the interpreter may serve as active collaborator.

The vagaries of book publishers make them a dubious financial resource for developing and sustaining other than the most altruistic of motivations on the one hand, or the most crass on the other. On the expectation that the potential interpreter is a realist, his career must be essentially subsidized. This makes his selection a highly important

matter: it should certainly not be based on the politics and cronyism of professional societies.

Perhaps the best basis for selection will be work he has already done which reflect interests and talents for the task. Once found and tested, he should be cherished by his patrons.

Models of Instruction

A high risk, high gain opportunity is the development of educational "packages" that incorporate the best interpretation of research findings and behavior models in the equivalent of a teaching unit in some one or repertoire of subject matters. Such a package must necessarily integrate the art of subject matter selection and organization, the arts of communication and a reference knowledge of behavior parameters and optimizing factors that may be revealed in the body of research knowledge at large.

The teaching unit must be large enough to encompass the equivalent of a "course" or course segment. Thus it has a logical and psychological beginning and end. It must be large enough to introduce such factors as scheduling, "evaluation," and representative administrative problems to be faced and solved. It must specify prerequisites for the supportive roles of teachers and students, and the means

whereby these prerequisites may be acquired if absent. At least examples of all aids and devices to support the package must be prepared, and pre-tested instructions provided teachers about how to develop their own variations and test them by one means or another that is practical in their environment.

The content of the package should have a detailed rationale for each class of design decision: selection of subject matter, organization of subject matter, communication format, interactive procedures between material and instructional vehicle and the student, and for the sequencing of content and procedure. This rationale may be at least as significant as the package it references. The rationale may be a design guide for extensions and modifications of the package by others, perhaps less knowledgeable and gifted. The rationale will (or should) also reveal the theoretical biases of the developers--which of necessity they will have. The explicit revelation of the assumptions more readily enables alternatives to be considered and even applied without necessarily disrupting the entire package. This is only a possibility. It would be technically informative if the rationale included statements about what alternatives were considered and why they were rejected. Such statements would

indicate the breadth of working knowledge available to the developers, suggest alternatives to be explored by other developers, and, most important of all, impart to other would-be designers the structure of thinking applied at a high level of expertise.

It is unrealistic to expect a rationale to completely account for and justify any development. Many of its decisions and realizations will be based on intuition and art. The rationale therefore cannot be a cookbook that would enable others automatically to generate a product of equivalent value. Rather it would be an account of the assumptions and general design strategies and tradeoffs used by a highly competent group of design collaborators proceding towards a set of defined objectives, who specified their materials as they went along.

The package would, of course, have to be pilot tested in order to eliminate gross bugs and enable the equivalent of "product engineering"--that is, reduction of costs by increasing efficiencies where possible and eliminating what appear as expensive frills that are not worth their cost. This cost reduction phase is an important aspect of any realistic development enterprise, and inevitably requires a searching reexamination of what is essential and what is

secondary to a set of objectives. By cost I do not imply only dollar costs, but also such factors as human time and effort and ability.

An adequately designed developmental package also is equipped to handle failure mechanisms. This requires anticipation of the various things that can go wrong, and procedures and alternatives for coping with them. The coping may not necessarily be adequate according to normative specifications, but some stipulation must be made for the management of performance failures or incidents. Examples: the students who reject the procedure, or who are unable to cope with it. The teacher who fails to grasp some element of the procedure, or mismanages it. A substitute teacher. A scheduled session that cannot be met and which must therefore be truncated into another session. A mechanical or electronic device that fails to work when scheduled.

Only those naive to the realities of the world omit attempts to anticipate the variety of "failure mechanisms" that can plague their package, and develop countermeasures for the most likely of them. The use of movie projectors and sound systems in classrooms should have taught some lessons in this regard: despite their potential intrinsic value,

teachers who have been embarrassed by the failures of these devices quickly abandon them, whatever their virtues. In the development of industrial products, this region of concern is called reliability and serviceability and is included in the computation of the benefits and the costs of the system.

A development enterprise should have a relatively fixed budget and a rather firmly fixed deadline for completion. These constraints impose a discipline and "set to work" which is essential for the completion of an enterprise. In this regard, the developmental attitude contrasts sharply with the research attitude which tends to be open-ended and may terminate at any date with the apology: "more research is needed." For this reason, I am skeptical that a research enterprise can be integrated with a developmental enterprise. There may be examples which demonstrate the contrary, but I am not directly familiar with them. The genuine researcher properly distrusts intuition (except perhaps as a hypothesis generator) and therefore considers the developer's basis for decisions as slovenly and even unethical. The developer realizes that he cannot optimize every design decision, and in fact that he must often make design decisions without clearly understanding the pattern of variables and implications underlying the decision. To the developer, analysis is a preliminary stage to serve synthesis of a product design;

to the researcher, analysis is a means justified in itself, or by synthesis into a theory. I offer these comments to bolster the recommendation that research and development are almost contradictory enterprises. One may support the other, but traditional research cannot be integrated into traditional development. A future discipline which I would call "general systems R & D" may change this picture, but the information gathering, organizing and processing capabilities of computers--as well as new concepts about the respective roles of research, development and operations--need to be realized.

Once the developmental package has been completed and tested for practicality, the problems of actual adoption assume priority. If the developmental phases have had the benefit of informal participation by representatives from the instructional establishment (as was the case with the AAAS project called Science--a Process Approach) a cadre for promotion, indoctrination and acceptance already exists. (I hope my readers are not offended by my treating educational products and concepts as if they were commercial products subject to Madison Avenue huckstering. But by whatever it may be called, the process of persuasion and identification of product with a want must occur whether the want exists or

is created. I believe it better to be direct, emphatic and open about it, than to sidestep with circumlocutions.) In any event, the problems of adoption of tangible products--the products of development--are very different from the problems of interpreting and adopting research ideas, concepts, models and data directly to the operational milieu of educators and educational institutions. Techniques do exist for the former.

Should state-of-the-instructional-art packages be set up primarily in special experimental schools? The liability is that the specialized setting may keep the target educators from easily picturing the development housed and running in their humbler environments. The experimental environment is bound to appear artificial and therefore inapplicable to the environment back home. The development should probably be demonstrated in settings that approximate those intended for adoption.

Clarification of Educational Objectives

This is a third (and much weaker) basis for moving the findings of research, and especially applied research, closer to operations in education. The means for such clarification are obscure. It would seem possible, however, to

define educational goals in such ways that the ends would more clearly identify the variables required by the means--especially in the structure of the communications between educational source and the learner. I believe that there are ways of characterizing objectives, say in terms of competence ranges rather than knowledge criteria, that will promote at least a clearer and more meaningful picture than descriptions of objectives as generally observed now.

To the extent that objectives can be described in process terms, it is easier to infer the essential processes for reaching them. This is in contrast to slogan-like definitions with little denotational content. I do not mean to imply by this statement objectives stated in terms of tests to be passed nor, in fact, objectives at the specific course level if indeed the "course" is to be considered as an appropriate unit at all. Guilford's Nature of Human Intelligence suggests a way to think about approaching a functional taxonomy of objectives. So does Gagne in his Conditions of Learning. I am preparing a book which follows a different rationale for identifying training and educational objectives based on information processing system models.

Style of Teacher Preparation

The education of educators programs the attitudes, beliefs, values and practices of the teacher in the classroom or the administrator in the decision box. To the extent that intellectual openness, attitudes of inquiry and the capacity to extract substantive issues from verbal abstractions can be instilled, along with some critical competence in the assessment of research published in various forms, the ground is laid and seeded for creative responsiveness to ideas and data. But this is a long-range objective, and perhaps less important in the large sense than a more direct objective: imparting the capacity for joy in constructive thought to be transmitted to students directly. This is perhaps fundamental to the spirit of active inquiry and thoughtful innovation where perhaps it counts most: the immediate and direct interaction between teacher and student in the learning process.

Opportunities for the Mavericks

Individuals may be creative and innovative in a field without having formal credentials or specialist backgrounds. It may be true that an Edison today could not do what Edison did in his time: contributions to technology require intensive specializations. This may be true in the engineering

and physical disciplines. But the disciplines of communication technique have not yet achieved the formalism of the hardware technologies. For example, the potentialities of computer-driven animated displays in two and three visual dimensions for the communication of concepts consisting of dynamic relationships among a family of variables have barely been talked about, much less explored. The comprehension of mathematics both as a process and as application could be revolutionized by successful probes in this direction. It would not need an educator, or laboratory researcher, or course developed to pioneer such a probe: just an individual with imagination who perceived a need and a resource and brought them together.

Let us call such an unconventional innovator a maverick. He has little or no opportunity for working out his ideas, and even less a forum for communicating and improving them. Unfortunately, his lack of command of professional jargon makes it difficult to distinguish him from a crackpot. At least one company has formally recognized the potential of this source of innovation, however. A suggestion procedure enables a proposal from any source to be seriously evaluated by a panel of "experts." Most of these experts

are not directly identified with the impact of the suggestion if it were put into effect--but some members of the panel are in that position. The company provides both prestige and tangible rewards where the suggestion is considered to have merit and is put to work. This company also has a "creative development" apparatus which modestly funds an individual who has what may seem a long-shot idea with potential payoff but no home. The proposal is examined by a panel whose orientation is primarily constructive and favorable rather than negative to such proposals. Perhaps the most significant part of the program is that the individual is given specific and scheduled time during work hours over a specified number of weeks or months for working on his idea. This operates much like an in-house contract. The payoff has not been enormous, but more than sufficient to continue funding the program. Although anybody is eligible, few try. But it does help find and encourage the few mavericks who are around.

Such programs are pointless unless there are outlet opportunities for application tryout. Concluding an exercise with no more than a report for the files makes the enterprise worthless. The key to the operation is the judging panel who have an implicit responsibility to help the inventor at least attempt to find a use .

If this reading is true, then perhaps inspired and competent leadership rather than research is the hedge against anarchy. This concept opens a different chapter about the introduction of innovation with the stage being set by such names as Hyman Rickover in submarines, Billy Mitchell in air transportation, F.D.R. in social reform.

REFERENCES

Ausubel, D. P. Educational Psychology: A Cognitive View. New York: Holt, Rinehart and Winston, 1968.

Chapanis, A. "The relevance of laboratory studies to practical situations." Ergonomics, Vol. 10, No. 5, 1967.

Bloom, B. S. (Ed.) Engalhart, M. D., Furst, E. J., Hill, W. H., Krathwohl, D. R. A Taxonomy of Educational Objectives: Handbook I, the Cognitive Domain. New York: Longmans, Green and Co., 1956.

Broudy, Harry. "Can research escape the dogma of behavioral objectives?" School Review, Vol. 79, Nov. 1970.

Deci, E. L. "Work--who does not like it and why." Psychology Today, Vol. 6, No. 3, August 1972.

Hunter, M. W., II. "Are technological upheavals inevitable?" Harvard Business Review, Vol. 47, No. 5, September-October 1969.

Gagne, R. M. The Conditions of Learning, Second Edition. New York: Holt, Rinehart and Winston, 1970.

Green, E. "The educational entrepreneur." Public Interest, No. 28, Summer 1972.

Guilford, J. P. The Nature of Human Intelligence. New York: McGraw-Hill, 1967.

Lawrence, P. R. "How to deal with resistance to change." Harvard Business Review, Vol. 47, No. 1, January-February 1969.

Lindvall, C. M. (Ed.) Defining Educational Objectives. Pittsburgh: University of Pittsburgh Press, 1964.

Mager, R. F. Preparing Objectives for Programmed Instruction. San Francisco: Fearon Press, 1962.

Miller, R. B. "Analysis and specification of behavior for training," in Training Research and Education. R. Glaser (Ed.) Pittsburgh: University of Pittsburgh Press, 1962.

Trapp, M. Knowledge Utilization in Education: A Review of Significant Theories and Research. University of Iowa, Center for the Advanced Study of Communication, Research Memorandum #7, 15 January 1972.

Research in Education. Educational Resources Information Center. U.S. Dept. of Health, Education and Welfare.